'History of the Complex Number,' by G. T. Sellew.

'The Motion of a Top taking into account the Rotation of the Earth,'** by A. S. Chessin.

'Kelvin's Treatment of Instantaneous and Permanent Sources extended to certain cases in which a Source is in Motion,'** by James McMahon.

'Oscillating Satellites',** by F. R. Moulton.

'On a Mechanism for drawing Trochoidal and allied Curves,'** by F. Morley.

'On Surfaces sibi-reciprocal under those contact Transformations which transform Spheres into Spheres,'** by P. F. Smith.

'On Singular Transformations in the Real Projective Group of the Place,'** by H. B. Newson.

'Report on Groups of an Infinite Order,' by G. A. Miller.

'On the Metabelian Groups whose Invariant Operators form a Cyclical Subgroup,' by W. B. Fite.

'Definitions and Examples of Galois Fields,' by L. E. Dickson.

'Construction Problems in non-Euclidean Geometry,' by G. B. Halsted.

'The Expression of a Rational Polynomial in a Series of Bessel Functions of the nth Order,' by James McMahon.

'Sundry Metrical Theorems connected with a special Curve of the 4th Order,' by F. H. Loud.

'The Directive Force of Philosophy upon Mathematics,' by Miss M. E. Trueblood.

'Die Hesse'sche und die Cayley'sche Curve,' ** by Paul Gordan.

'On the Rational Quartic Curve in Space,'** by F. Morley.

'On a Special Form of Annular Surfaces,'** by Virgil Snyder.

'On Hyper-complex Number Systems,'** by H. E. Hawkes.

'Application of a Method of d'Alembert to the Proof of Sturm's Theorem of Comparison,'** by Maxime Bôcher.

'Theorems on Imprimitive Groups,'** by H. W. Kuhn.

'A Simple Proof of the Fundamental Cauchy Goursat Theorem,** by E. H. Moore.

'On the Existence of the Green's Function for simply connected plane Regions bounded by a general Jordan Curve, and for Regions having a more general Boundary of positive Content,'** by W. F. Osgood.

'Quaternions and Spherical Trigonometry,'** by J. V. Collins.

'The Reduction of Binary Quantics to Canonical Form by Linear Transformation,'** by Miss B. E. Grow.

** American Mathematical Society paper.

'Some Remarks on Tetraedral Geometry,'** by H. E. Timerding.

Organized discussion of the question, What courses in Mathematics should be offered to the student who desires to devote one-half, one-third, or one-fourth of his undergraduate time to preparation for graduate work in Mathematics.** Opened by J. Harkness, E. H. Moore, F. Morley, W. F. Osgood and J. W. A. Young.

WENDELL M. STRONG,
Secretary.

PHYSICS AT THE AMERICAN ASSOCIATION.

IT was happily arranged this year that the Physical Society should meet with Section B, and this contributed to ensure a better attendance than was at first anticipated.

There were 29 papers presented before Section B, and 13 before the Physical Society. All but four were read.

The prominent characteristic of the papers presented was the care and thoroughness with which the experimental work forming the basis of the communications had been carried out. In this we see the influence of the German University training which so many of our physicists have received, but in addition to this there is superadded an ingenuity, and an adaptation of means to an end which is peculiarly American, and the result is a series of papers of the most admirable character.

Possibly the paper which excited most general interest was that of Professor R. W. Wood, on the 'Photography of Sound Waves.' The excellent photographs of the sound waves themselves, in practically every phase of transmission and reflection, and the kinetoscopic reproductions of their movement certainly marked an epoch in the history of the subject. A second paper 'On the application of the Schlieren method to the microscope,' illustrated a method apparently destined to be of the greatest value.

Another extremely valuable paper was that of Dr. Bedell, on 'Copper Saving in

** American Mathematical Society paper.

the Joint Transmission of Direct and Alternating Currents.' The author showed that when direct and alternating currents are sent over the same line, each behaves as if the other were not there, and that thus the same line can be used for two separate systems of transmission of energy, at the cost of a single line. This would seem to remove the last objection to the general use of the alternating current system and it is probable that the method will be extensively used.

In a paper on the 'Visible Radiation from Carbon,' Professor Nichols brought out the surprising fact that the radiation from carbons of the types used in incandescent lamp filaments is not, as has hitherto been generally assumed, of the same type as that from a perfectly black body, but that the radiation is *selective*, the radiation from that part of the spectrum between the red or the yellow being much greater than it is in the case of a black body. It thus becomes impossible to estimate the temperature of heated carbon from its radiation, but on the other hand a number of questions of the greatest interest are opened up which we may hope Professor Nichols' further researches will explain and which will result in considerable extensions to our knowledge of the subject.

In a paper by Professors Guthe and Trowbridge on the 'Coherer,' the authors find that their experiments on the properties of contacts can all be expressed by a single differential equation. A large number of facts are thus simply correlated, and a striking advance made in the theory of the subject.

Of a paper by Frank Allen on the 'Effect upon the Persistence of Vision of Exposing the Eye to Light of Various Wave Lengths,' in which a method suggested by Professor Nichols was used, it can only be said that it is one of those papers in regard to which, notwithstanding the apparent absence of all flaws in the admirable experimental work we are forced to reserve our opinion, since the results obtained are so utterly at variance with our preconceived ideas. No one, for example, who has done much spectro-photometry, would have anticipated that it would have been possible to obtain color curves of subjects on different days to an accuracy of less than two per cent. Again, the fact, brought out by the author's work, that an eye fatigued by yellow has its persistence altered for the red and green and not for the yellow which originally fatigued it, is apparently inconceivable.

But it is one of the fine things of science that it is perpetually impressing upon us the fact that we do not know everything yet, even in those cases where we are apt to feel that we can be most positive, so that the truly scientific man must be, at the same time very conservative, and yet capable of even greater efforts of mental gymnastics than Alice's White Queen, whom conscientious practice, in conjunction with shutting the eyes and breathing hard, had enabled to believe no less than six impossible things before breakfast. And it is quite possible that further evidence will show that we must really change our preconceived ideas in regard to color in a number of important respects. Accepting the experimental results, there would seem, as the author pointed out, no escape from the conclusion that the three fundamental color sensations are those of the red, green and violet. This is a most important result, and is to a certain extent corroborated by Mr. Ives, who in the course of a charming exposition of his three color processes during the meeting, took occasion to point out that the only screens which gave satisfactory results for such work were a red, a green and a blue-violet one.

Another very valuable paper was that by Merritt, on 'The Production of Kathode Rays by Ultra-Violet Light.' A charged disc was illuminated by ultra-violet light,

and it was shown that negatively charged particles were thrown off which possessed the properties of the cathode rays in that they were reflectible by magnetism, carried negative charges and rendered air conducting. Crookes theory of the nature of the cathode rays is thus abundantly fortified. Merritt's Vice-Presidential address was on a similar subject, and evoked great interest.

In a paper on 'A New Theory of the Electromagnetic Rotation of Light,' the writer showed that whenever light is absorbed certain phase relations between the electric and magnetic forces and fluxes in the wave are shifted in such a way as to make the plane of the wave rotate when placed in a magnetic field, and evidence was given tending to show that this is a sufficient and probable explanation of the phenomenon.

A paper by Professor F. A. Bigelow on the method of reducing barometric observation was unfortunately read by title only, as it seemed, from the abstract, to contain some very valuable suggestions and data. Two papers were read by Professor Franklin, one on 'Lecture Room Demonstrations of the Elementary Theory of Elasticity,' in which some extremely ingenious methods of illustrating such phenomena were given; the other a more abstract and mathematical paper upon 'The Flow of Energy round a Conducting Screen near a Current Sheet.' Other papers read before this section were those of Anthony, 'An Observation upon the Surface Tension of Mercury'; Knipp, 'Surface Tension of Water above 100°'; Reed, 'On Temperature Effects on a Tuning Fork' (the last two containing a large amount of very valuable experimental data). Edward Atkinson read a paper on 'The Diffusion of Light,' treating the question from the standpoint of the manufacturer's and insurance company's standpoint. As Mr. Atkinson's work has been one of the chief determining factors in the method of lighting large factories in New England and elsewhere, his remarks were of more than general interst. He brought out the interesting fact that, whilst fire losses in the days of gas had been very high, electric lighting, installed under the regulations which he and his companies had drawn up, had brought them down to almost a negligible amount. The papers, 'The Percentage Bridge and its Applications,' by H. C. Parker; 'Power Curves from Alternating Current Circuits,' by Rosa; 'Circuit Breakers and Induction Coils' and 'Experiments in Electric Lighting' by the writer, covered various forms of apparatus. Some very beautiful photographs of electrical discharges were shown by T. B. Kinraide, and though the section did not apparently agree at all with his theories, all were united in their appreciation of the results obtained and of the apparatus used in their production. Other papers which may be mentioned are those by Professor Carhart 'On the Thermodynamics of the Voltaic Cell'; C. H. Williams, 'On an Improved Lantern for Testing Color Perception'; A. D. Cole, 'On the use of the Capillary Electrometer' describing an interesting modification, much more sensitive than the usual form; and the paper by I. S. Stevens, 'On a Method for Measuring Surface Tension.' As a whole it will be seen that the standard of the papers read was of a very high order, and of more than usual interest.

It will be impossible to more than mention a few of the papers which were read before the Physical Society: Reese, 'On Zeeman Effect'; Potts, 'On Electric Absorption in Condensers'; Dorsey, 'On the Polarization of the Solar Corona'; Nichols, 'Preliminary Tests on the Efficiency of Acetylene Flame as a means of Illumination'; Tufts, 'On Some Simple Apparatus for the Study of Aërial Vibration'; Knipp, 'On the Use of the Bicycle Wheel in Illustrating the Principles of the Gyroscope';

Rosa, 'On the Measurement of Alternating Electromotive Forces of High Potentials'; Bauer, 'On the Results of Simultaneous Magnetic Observations made at various points on May 28, 1900' and Wood 'On a Mica Echelon Spectroscope Grating' are some of the titles, which show that the meeting of this Society was fully as successful as that of Section B. Dr. Bauer's paper brought out the very interesting fact that at the time of the recent solar eclipse there was a distinct variation in the magnetic elements at a number of points on or near the line of totality, and that the change was not simultaneous, but depended upon the time of totality.

To sum up, it may safely be said that the admirable papers and admirable surroundings made the present meeting of the Section B one of the most enjoyable of recent years.

R. A. FESSENDEN,
Secretary.

SCIENTIFIC BOOKS.

The Cell in Development and Inheritance. By EDMUND B. WILSON. Columbia University Biological Series, Vol. IV. Second Edition. Revised and Enlarged. New York and London, The Macmillan Co. 1900. Pp. xxi + 483, with 194 figures in the text. Price, $3.50.

The appearance of the second edition of this already famous work gives occasion for calling attention not only to the changes which it has undergone, as contrasted with the first edition, but also to its general plan and character.

At the present time the greatest problems of biology are those which center in the life of the animal and plant cell. Assimilation, growth, metabolism, reproduction, inheritance, development and even evolution are subjects upon which the study of the cell has thrown a flood of light. The cell theory has indeed attained a prominence in modern biological work, second only to the evolution theory. The appearance, therefore, of a general work on the cell is of more than ordinary concern, not alone to the biologist, but also to all persons interested in the fundamental problems of biology.

Professor Wilson's work on the cell, the first edition of which appeared in 1896, at once took first rank among books on cytology. It is not only a general summary of the results of cell studies, but also a most important contribution to knowledge. The author has brought together, under one point of view the very many isolated observations and frequently conflicting views of a multitude of writers. In this he has graciously and entirely avoided the old museum idea of collecting material without reference to its use; although he touches upon almost every important work of modern times bearing upon the cell, yet the book is no mere encyclopedia of facts or theories—all is treated in a critical spirit as so much material to be builded into a system. The labor involved in this sifting of literature and collation of results must have been prodigious and all workers in these lines owe Professor Wilson a debt of gratitude for the service which he has thus rendered.

The general plan and scope of the second edition of this work remain unaltered; in fact the subdivisions into chapters and sections remain almost exactly the same as in the first edition. After an introduction in which is given a brief but suggestive sketch of the cell theory and its relation to the evolution theory, there follow in successive chapters: (1) A general sketch of cell structure; (2) cell-division; (3) the germ cells; (4) fertilization of the ovum; (5) oögenesis and spermatogenesis, reduction of the chromosomes; (6) some problems of cell organization; (7) cell chemistry and cell physiology; (8) cell division and development, and finally (9) some theories of inheritance and development. The volume also contains an excellent glossary, a general literature list, and indices of authors and subjects.

The most important changes in the second edition are found in those chapters and sections which deal with the nature and functions of the centrosome. For the past ten years this has been one of the most perplexing problems of cytology. In 1887 both Van Beneden and Boveri maintained that the centrosome was an independent and permanent cell organ, and Boveri held that the most important event in the fertilization of the egg was the addition of